

REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

Claims 1-34 are in this Application.

Claim 25 is objected to for formal reasons.

Claims 1-34 have been rejected under 35 U.S.C. §103.

Claims 1, 2, 10 and 25 are amended herewith.

New claims 35 to 43 are entered.

Amendments To The Claims

Claim 1 has been amended to read:

An ink composition for printing on a glass substrate, to be fused to the substrate upon firing, the ink characterized by:

(a) having viscosity, below 20cps at jetting temperature;

(b) becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C; the ink composition comprising:

1) a non-wax vehicle being a liquid at room temperature;

2) sub-micron particles of binding composition.

Support for the feature "below 700 degrees" is found in the specification at least at page 7, line 25. Support for the feature "glass substrate" is found in the specification at least at page 6, lines 1-11.

Applicant respectfully suggests the negative limitation "non-wax" has basis in the original disclosure at least at page 3 line 1 to page 4, line 25 as required by MPEP § 2173.05 (i).

Alternatively or additionally, Applicant respectfully suggests that this feature *should reasonably have been expected to be claimed*. (MPEP § 706.07(a)) as it is part of the stated rationale for the invention.

Applicant notes that MPEP § 904 explicitly states: "*The first search should cover the invention as described and claimed, including the inventive concepts toward which the claims appear to be directed.*" Therefore, any new reference brought in response to the non-wax vehicle amendment should be brought in a non-final office action.

Dependent claim 2 has been amended to reduce linguistic redundancy with claim 1. This is a purely cosmetic change which does not alter claim scope.

Dependent claim 10 has been amended to reduce linguistic redundancy with amended claim 1. This is a purely cosmetic change which does not alter claim scope.

Dependent claim 25 has been amended to address issues of antecedent basis raised by the Examiner. This is a purely cosmetic change which does not alter claim scope.

Applicants respectfully suggest that none of these amendments introduce new matter into the application.

New Claims

New claim 35 is entered herewith. New claim 35 corresponds to previous dependent claim 9 and original claim 1 with the features of intervening claim 8.

Applicant respectfully suggests that new claim 35 is identical to original claim 9 in independent form and does not introduce any new matter into the application.

New claim 36 includes features previously presented in original claim 1 phrased as a method claim. Claim 36 is patentable over the cited references at least by virtue of the feature "applying the ink to the ceramic substrate at a viscosity, below 20cps". The Doyle reference (paragraphs 0030 and 0031) teaches against this possibility by teaching a phase change ink which solidifies upon contact with the substrate.

New dependent claim 37 is a method claim which includes the composition of current claim 1 as a feature and is in condition for allowance at least by virtue of its dependence from claim 1. New dependent claims 38-42 are in condition for allowance at least by virtue of their dependence

from claim 37. Features in these dependent claims are all literally supported at least by the original specification at page 16, lines 27 to 30 and page 20 beginning at line 6.

New independent claim 43 is supported at least by original claim 1 and the specification at page 16, lines 27 to 30 and page 20 beginning at line 6.

With regard to the new claims, Applicant respectfully suggests that they include only *subject matter which the examiner reasonably anticipates might be incorporated into applicant's amendment* (MPEP § 904.03), so that any rejection of these claims should occur in a non-final office action.

Claim objections

The Examiner has objected to claim 25 because the term "silica nanoparticles" lacked antecedent basis. Applicant responds by amending "silica nanoparticles" to -- sub-micron particles of binding composition -- which has antecedent basis in claim 1.

Applicant thanks the Examiner for pointing out this obvious typographical error.

35 U.S.C. § 103 Rejections: Doyle in view of Hayakawa

The Examiner has rejected claims 1-8, 10, 15, and 32-33 under § 103 (a) as being unpatentable over EP 1 223 201 (hereinafter Doyle) in view of US 5421877 (hereinafter Hayakawa).

Applicant respectfully suggests that Claim 1 as currently amended is patentable over Doyle in view of Hayakawa.

Claim 1 as currently before the Examiner is directed towards (**emphasis** added):

An ink composition for printing on a glass substrate, to be fused to the substrate upon firing, the ink characterized by:

(a) *having viscosity, below 20cps at jetting temperature;*

(b) *becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C;*

the ink composition comprising:

1) *a non-wax vehicle being a liquid at room temperature;*

2) *sub-micron particles of binding composition.*

Doyle expressly states (paragraph [0051]) that:

After printing the printed ink and substrate may be fired typically at temperatures of from 700 DEG C to 1300 DEG C, preferably glass articles will be fired at a temperature of from 700 DEG C to 800 DEG C and ceramic articles will be fired at temperatures of from 900 DEG C to 1200 DEG C,

Thus, Doyle does not meet the claimed features of "*An ink composition for printing on a glass substrate, and becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C.*" Specifically, there is no indication in Doyle that heating an ink applied to a glass substrate to any temperature below 700 degrees is useful, advantageous or even sufficient. Applicant notes in passing that many types of glass melt or deform at temperatures above 700 degrees.

Hayakawa is completely silent as to the possibility of the ink *becoming an integral part of the substrate* at any temperature.

Thus even if there were reason to combine Doyle with Hayakawa, such combination does not produce what is instantly claimed.

Alternatively or additionally, the Doyle reference precludes the use of a *non-wax vehicle* as instantly claimed in claim 1.

Doyle teaches (emphases added):

[paragraphs 006; 0020 0022 and numerous other occurrences] "... the carrier having a melting point for phase change of the ink."; and

[0023] The invention further provides a method of producing an ink in a form for ink jet printing comprising the steps of:-

milling a fusible vitreous agent to provide a powder having a particle size less than 10 μm ;

providing a pigment for the ink;

heating a phase change carrier, and mixing the powder with the molten carrier; and

allowing the carrier to cool to provide solid ink.

These teachings are central to the stated purpose of the Doyle ink:

[0031] The ink is a phase change ink. In other words the ink remains in a solid form while in storage and when the temperature of the printer is lower than the melting point of the ink carrier material, for example when the printer is switched off. When the printer is operating the ink is heated to a temperature which is higher than the melting point of the carrier material, the carrier material melts, and the ink becomes liquid. In this way no sedimentation of the ceramic particles occurs while the ink is in storage thus effectively and significantly increasing the shelf life of the ink. The ink can be inkjet printed onto ceramic, glass, metal and other heat-resistant materials. The print is subsequently fired to remove the organic constituents of the ink and to fuse the pigment constituents to the substrate.

Doyle expressly links achievement of phase change to use of a wax carrier:

[0032] The carrier material is a wax material such as paraffin wax, an example of which is, Parafloint C77 TM , produced by Schuman Sasol GmbH, Hamburg, Germany. However, any other suitable wax or wax-like

material such as, but not limited to, those outlined in Table 1 below may be used (mp = melting point).

Applicant notes that there is no mention in Hayakawa of how to produce the phase change desired by Doyle using a non-wax vehicle as instantly claimed in claim 1. Thus, combination of the phase change teachings of Doyle with any non-wax vehicle which might be found in the Hayakawa reference would serve only to render the Doyle ink unsuitable for its stated purpose.

Thus claim 1 as currently amended is patentable over Doyle in view of Hayakawa for at least two separate reasons.

Claims 2-8, 10, 15, and 32-33 are each patentable over Doyle in view of Hayakawa at least by virtue of their dependence from claim 1. New claim 36 is patentable over Doyle in view of Hayakawa at least for similar reasons.

Alternatively or additionally, there is no prima facie case for rejection of dependent claim 8 as unpatentable over Doyle in view of Hayakawa. Dependent claim 8 adds the feature " wherein the liquid vehicle is at least one organic solvent". In rejecting claim 8, the Examiner points to Table 1 of Doyle as reciting an organic solvent. However, Table 1 of Doyle recites polyethylene with a melting point of 90-120 degrees. Therefore, combination of Doyle and Hayakawa does not produce what is claimed in original claim 8 because there

is no teaching in either reference of an organic solvent **vehicle being a liquid at room temperature** as instantly claimed in original base claim 1. Applicant notes that there is no *prima facie* case for original claim 8 on record and reserves the right to re-draft original claim 8 in independent form including the features of original base claim 1.

35 U.S.C. §103 Rejections: Doyle in view of Hayakawa and

Nyssen

The Examiner has rejected claims 9, 16 and 22 under §103(a) as being unpatentable over Doyle in view of Hayakawa and US 6245138 (hereinafter Nyssen).

Claims 9, 16 and 22 all depend from claim 1 directly or indirectly. Applicant has demonstrated that combination of Doyle and Hayakawa does not produce all of the features of claim 1 as set forth in detail hereinabove. Nyssen does not provide the missing features. Specifically Nyssen is completely silent as to the possibility of **An ink composition for printing on a glass substrate, and becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C.** Therefore, claims 9, 16 and 22 are all patentable over Doyle in view of Hayakawa and Nyssen at least by virtue of their dependence from claim 1.

Alternatively or additionally, Applicant respectfully suggests that the Examiner has not made a *prima facie* case for rejection of original claim 9, which is currently before the Examiner as new claim 35. Claim 35 is directed towards:

An ink composition for printing on a ceramic substrate, to be fused to the substrate upon firing, the ink characterized by:

- (a) *having viscosity, below 20cps at jetting temperature;*
- (b) *becoming an integral part of the substrate upon exposure to temperatures above 500°C;*
the ink composition comprising:

1) *a vehicle being a liquid at room temperature and comprising at least one organic solvent selected from the group consisting of PM (propylene glycol mono methyl ether), DPM (dipropylene glycol mono methyl ether), TPM (tripropylene glycol mono methyl ether), PnB (propylene glycol mono n-butyl ether), DPnB (dipropylene glycol mono butyl ether), TPnB (tripropylene glycol mono n-butyl ether), PnP (propylene glycol mono propyl ether), DPnP (dipropylene glycol mono propyl ether), TPnB-H (propylene glycol butyl ether), PMA (propylene glycol mono methyl ether acetate), Dowanol DB (Diethylene glycol mono butyl ether) or other ethylene or propylene glycol ethers; and a combination of two or more of the above listed solvents and*

2) *sub-micron particles of binding composition.*

Applicant respectfully points out that the only solvent carrier mentioned by Doyle (table 1 of Doyle) is polyethylene with a melting point of 90 to 120 degrees centigrade. Doyle's solvent does not meet the feature *being a liquid at room temperature.*

Hayakawa describes (EXAMPLE 1; **emphasis** added) :

...the second mixture was diluted with a certain amount of a solvent such as alpha-terpineol or butyl carbitol so as to prepare a ceramic color composition in the form of paste having a certain desired viscosity ranging from about 250 to about 350 P.

Hayakawa's solvent does not meet the feature being a liquid at room temperature.

Therefore, combination of Doyle and Hayakawa would not produce **a vehicle being a liquid at room temperature and comprising at least one organic solvent** as instantly claimed.

In combining Nyssen with Doyle and Hayakawa, the Examiner states "One of ordinary skill would have been motivated to use these [Nyssen's] solvents in the Doyle and Hayakawa compositions if one desired to prepare the compositions as a non-phase change ink."

Applicant notes that Doyle states [**emphases** added] :

[0031] The ink is a phase change ink. In other words the ink remains in a solid form while in storage and when the temperature of the printer is lower than the melting point of the ink carrier material, for example when the printer is switched off. When the printer is operating the ink is heated to a temperature which is higher than the melting point of the carrier material, the carrier material melts, and the ink becomes liquid. In this way no sedimentation of the ceramic particles occurs while the ink is in storage thus effectively and significantly increasing the shelf life of the ink.

Thus, the Examiner's statement about the tendency of one of ordinary skill in the art to use Doyle as a basis for formulating a non-phase change ink seem to be nothing more than hindsight motivated by the instant specification. Any attempt by one of ordinary skill to convert the Doyle ink to a non-phase change formulation would run counter to the stated purpose of the Doyle ink.

Nyssen, although he describes use of an ink-jet ink containing organic solvents, is completely silent as to the possibility of ***printing on a ceramic substrate*** and to the possibility of the ink ***becoming an integral part of the substrate upon exposure to temperatures above 500.***

Applicant respectfully suggests that the Examiner has not made a *prima facie* case for a §103 rejection of original claim 9, now presented as claim 35, based upon Doyle in view of Hayakawa and Nyssen because the Examiner's conclusory statements disregard the express teachings of the Doyle reference. In view of Doyle's expressly stated guiding principle, the claimed invention "as a whole" would not have been obvious to one of ordinary skill in the art using Doyle as a starting point.

35 U.S.C. §103 Rejections: Doyle in view of Hayakawa and Kniajer

The Examiner has rejected claims 11-14 under § 103 (a) as being unpatentable over Doyle in view of Hayakawa and US 6346493 (hereinafter Kniajer).

Claims 11-14 all depend from claim 1 directly or indirectly. Applicant has demonstrated that combination of Doyle and Hayakawa does not produce all of the features of claim 1 as set forth in detail hereinabove. Kniajer does not provide the missing features. Specifically Kniajer is completely silent as to the possibility of ***An ink composition for printing on a glass substrate, and becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C.***

Alternatively or additionally, Applicant notes that there is no mention in Kniajer of how to produce the phase change desired by Doyle using a non-wax vehicle as instantly claimed in claim 1. Thus, combination of the phase change teachings of Doyle with any non-wax vehicle which might be found in the Kniajer reference would serve only to render the Doyle ink unsuitable for its stated purpose.

Therefore, claims 11-14 are all patentable over Doyle in view of Hayakawa and Kniajer at least by virtue of their dependence from claim 1.

35 U.S.C. § 103 Rejections: Doyle in view of Hayakawa and Aoki

The Examiner has rejected claims 17-18 and 34 under § 103 (a) as being unpatentable over Doyle in view of Hayakawa and US 5743946 (hereinafter Aoki).

Claims 17-18 and 34 all depend from claim 1 directly or indirectly. Applicant has demonstrated that combination of Doyle and Hayakawa does not produce all of the features of claim 1 as set forth in detail hereinabove. Aoki does not provide the missing features. Specifically Nyssen is completely silent as to the possibility of ***An ink composition for printing on a glass substrate, and becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C.***

Alternatively or additionally, Applicant notes that there is no mention in Aoki of how to produce the phase change desired by Doyle using a non-wax vehicle as instantly claimed in claim 1. Thus, combination of the phase change teachings of Doyle with any non-wax vehicle which might be found in the Aoki reference would serve only to render the Doyle ink unsuitable for its stated purpose.

Therefore, claims 17-18 and 34 are all patentable over Doyle in view of Hayakawa and Aoki at least by virtue of their dependence from claim 1.

35 U.S.C. §103 Rejections: Doyle in view of Hayakawa and

Herrmann

The Examiner has rejected claims 19-21 under § 103 (a) as being unpatentable over Doyle in view of Hayakawa and US 6332943 (hereinafter *Herrmann*).

Claims 19-21 all depend from claim 1 directly or indirectly. Applicant has demonstrated that combination of Doyle and Hayakawa does not produce all of the features of claim 1 as set forth in detail hereinabove. Herrmann does not provide the missing features. Specifically Herrmann is completely silent as to the possibility of ***An ink composition for printing on a glass substrate, and becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C***.

Alternatively or additionally, Applicant notes that there is no mention in Herrmann of how to produce the phase change desired by Doyle using a non-wax vehicle as instantly claimed in claim 1. Thus, combination of the phase change teachings of Doyle with any non-wax vehicle which might be found in the Herrmann reference would serve only to render the Doyle ink unsuitable for its stated purpose.

Therefore, claims 19-21 are all patentable over Doyle in view of Hayakawa and Herrmann at least by virtue of their dependence from claim 1.

35 U.S.C. § 103 Rejections: Doyle in view of Hayakawa,

Nyssen and Morris

The Examiner has rejected claims 23-24 and 29-30 under § 103 (a) as being unpatentable over Doyle in view of Hayakawa and Nyssen and US 5269840 (hereinafter *Morris*).

Claims 23-24 and 29-30 all depend from claim 1 directly or indirectly. Applicant has demonstrated that combination of Doyle and Hayakawa and Nyssen does not produce all of the features of claim 1 as set forth in detail hereinabove. Morris does not provide the missing features. Specifically Morris is completely silent as to the possibility of *An ink composition for printing on a glass substrate, and becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C.*

Alternatively or additionally, Applicant notes that there is no mention in Morris of how to produce the phase change desired by Doyle using a non-wax vehicle as instantly claimed in claim 1. Thus, combination of the phase change teachings of Doyle with any non-wax vehicle which might be found in the Morris reference would serve only to render the Doyle ink unsuitable for its stated purpose.

Therefore, claims 19-21 are all patentable over Doyle in view of Hayakawa and Herrmann at least by virtue of their dependence from claim 1.

35 U.S.C. § 103 Rejections: Doyle in view of Hayakawa, Nyssen

and Woolf

The Examiner has rejected claims 25-28 under § 103 (a) as being unpatentable over Doyle in view of Hayakawa and Nyssen and US 5897694 (hereinafter *Woolf*).

Claims 25-28 all depend from claim 1 directly or indirectly. Applicant has demonstrated that combination of Doyle and Hayakawa and Nyssen does not produce all of the features of claim 1 as set forth in detail hereinabove. *Woolf* does not provide the missing features. Specifically *Woolf* is completely silent as to the possibility of ***An ink composition for printing on a glass substrate, and becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C.***

Alternatively or additionally, Applicant notes that there is no mention in *Woolf* of how to produce the phase change desired by Doyle using a non-wax vehicle as instantly claimed in claim 1. Thus, combination of the phase change teachings of Doyle with any non-wax vehicle which might be found in the *Woolf* reference would serve only to render the Doyle ink unsuitable for its stated purpose.

Therefore, claims 25-28 are all patentable over Doyle in view of Hayakawa, Nyssen and *Woolf* at least by virtue of their dependence from claim 1.

35 U.S.C. § 103 Rejections: Doyle in view of Hayakawa, Morris

and Zhu

The Examiner has rejected claim 31 under § 103 (a) as being unpatentable over Doyle in view of Hayakawa and Morris and US 6251175 (hereinafter *Zhu*).

Claim 31 depends from claim 1. Applicant has demonstrated that combination of Doyle and Hayakawa [and Nyssen] and Morris does not produce all of the features of claim 1 as set forth in detail hereinabove. Zhu does not provide the missing features. Specifically Zhu is completely silent as to the possibility of **An ink composition for printing on a glass substrate, and becoming an integral part of the substrate upon exposure to temperatures above 500°C and below 700°C.**

Alternatively or additionally, Applicant notes that there is no mention in Zhu of how to produce the phase change desired by Doyle using a non-wax vehicle as instantly claimed in claim 1. Thus, combination of the phase change teachings of Doyle with any non-wax vehicle which might be found in the Zhu reference would serve only to render the Doyle ink unsuitable for its stated purpose.

Therefore, claim 31 is patentable over Doyle in view of Hayakawa and Morris and Zhu at least by virtue of its dependence from claim 1.

All issues raised by the Examiner have been addressed.

In view of the above amendments and remarks it is respectfully submitted that claims 1-34 as well as new claims 35-43 are now in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited. In the unlikely event that a notice of allowance is not forthcoming, an additional non-final office action would be proper since:

- 1) no amendments which necessitate new grounds of rejection are entered; and/or
- 2) there is no *prima facie* case for rejection of original dependent claim 8 on the record.

Applicant's representative is amenable to a telephone interview in lieu of an additional non-final office action in order to attempt to resolve any remaining issues.

Respectfully submitted,

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